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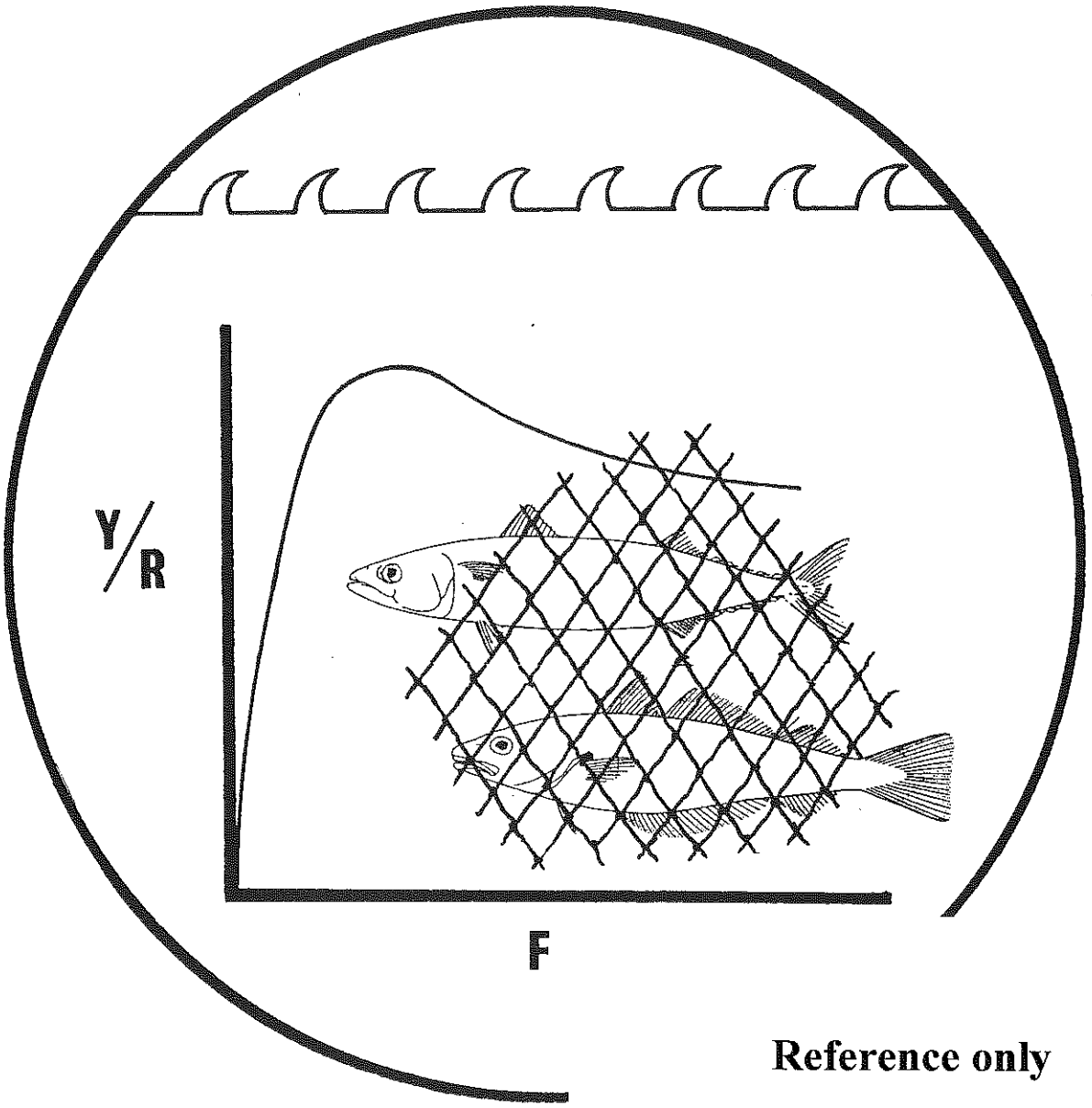

Edward Fahy and Paul Gleeson

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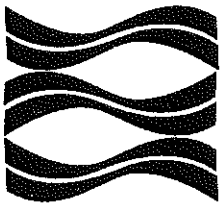

Roinn na Mara

(Department of the Marine)

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Aspects of the exploitation of hake *Merluccius merluccius* belonging to the northern stock by fleets based in Ireland.

by

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ABSTRACT

The development of the hake fishery in the ICES Divisions adjoining Ireland displays strong similarities to the fishery for megrim; Ireland's landings of hake rose from 100t per year in 1979 to 2,000t ten years later. Most hake comes from Divisions VIIg-k.

The Communities Logbook of the Irish-Spanish joint venture fleet provides a short time series. CPUE by both demersal trawl and long line declined sharply between 1985 and 1991. The second quarter is the most productive of hake landings but otherwise there is no clear seasonal pattern.

Hake were sampled on a half yearly basis and the fish were aged on the otoliths with a success rate of 70%. Ages in the first half were adjusted to a birthdate of 1 January. Mean lengths at age were higher than those calculated by statistical methods (Normsep.). Length frequencies indicated two age groups in the discards.

Methods of capturing hake have altered over the past five years, gill nets have increased their share of the Irish catch and, in 1991, were a close second to demersal trawl. Age of recruitment to the landings is 2-4 years.

Discard hake was calculated at 25-163% by weight of landings per quarter in 1991, higher values coming from small-meshed nets targeting *Nephrops*. Survivorship curves based on aged length frequencies of hake taken by whitefish boats provided F values of between 0.40 and 0.76. These results are high and together with sharply declining CPUE would seem to suggest the part of the stock in Divisions VIIb-c and VIIg-k is more heavily fished than the stock in other parts of Sub-area VII.

INTRODUCTION

Development of the hake fishery

The exploitation of hake in the ICES divisions adjoining Ireland displays marked similarities with the development of the fishery for megrim (Fahy and Fannon, 1992). Divisions VIIg-k are the source of most hake (Fig. 1). France, Spain, the UK and, latterly, Ireland, accounted for more than 99% of the landings taken in Divisions VIa, VIIa and VIIg-k between 1960 and 1986, the last year for which finalised statistics are available. Of these four nations, France and Spain take the vast majority of the landings.

Prior to 1970 landings by Spain were reported to ICES only occasionally although, when a report was made in 1965 the tonnage was substantial. Between 1974 and 1976 Spain took as much hake as the other participants in the fishery combined and the total landings reached a peak in these years (Fig. 2). The introduction of the European Common Fisheries Zone in 1977 appears to have curtailed Spanish landings.

Ireland rarely landed more than 100t of hake annually until the formation of the first joint venture company, Eiranova, in Castletownbere in 1979, after which landings to this country increased rapidly to 1,980t in 1986 (Fig. 2).

Throughout the 26 years reviewed, the relative contribution of hake by ICES divisions surrounding Ireland has remained fairly constant, VIIg-k producing most, and Ireland's expanding hake fishery has become increasingly reliant on these.

Recent history of the fishery

Catch effort data by Spanish joint venture vessels as reported in the Communities' Logbook since 1985 provided a brief time series on this species (Table 1). Both joint venture demersal trawl and long line are fished in the vicinity of the 200m depth contour, the latter having a wider range than the former (Fig. 3; Fahy and Gleeson, 1992). Several other indices of longer duration are available for Sub-area VII and for other sub-areas. Whereas CPUE indices have been increasing in Sub-area VIII, those in Sub-areas IV,VI and VII have shown some decline. Over the brief time series almost all correlations of Irish joint venture data with time series for other nations proved non-significant, the trawl and long line figures being in closest agreement (Table 2). The only significant correlation however ($P<0.05$) was between the Irish joint venture trawl and a French trawl fleet in sub-area VIII and that was negative.

Seasonality

Table 1 indicates the importance of the second quarter in the catches of hake, particularly by long line. Information on the size composition of catches is however less seasonally distinguished. The most crude

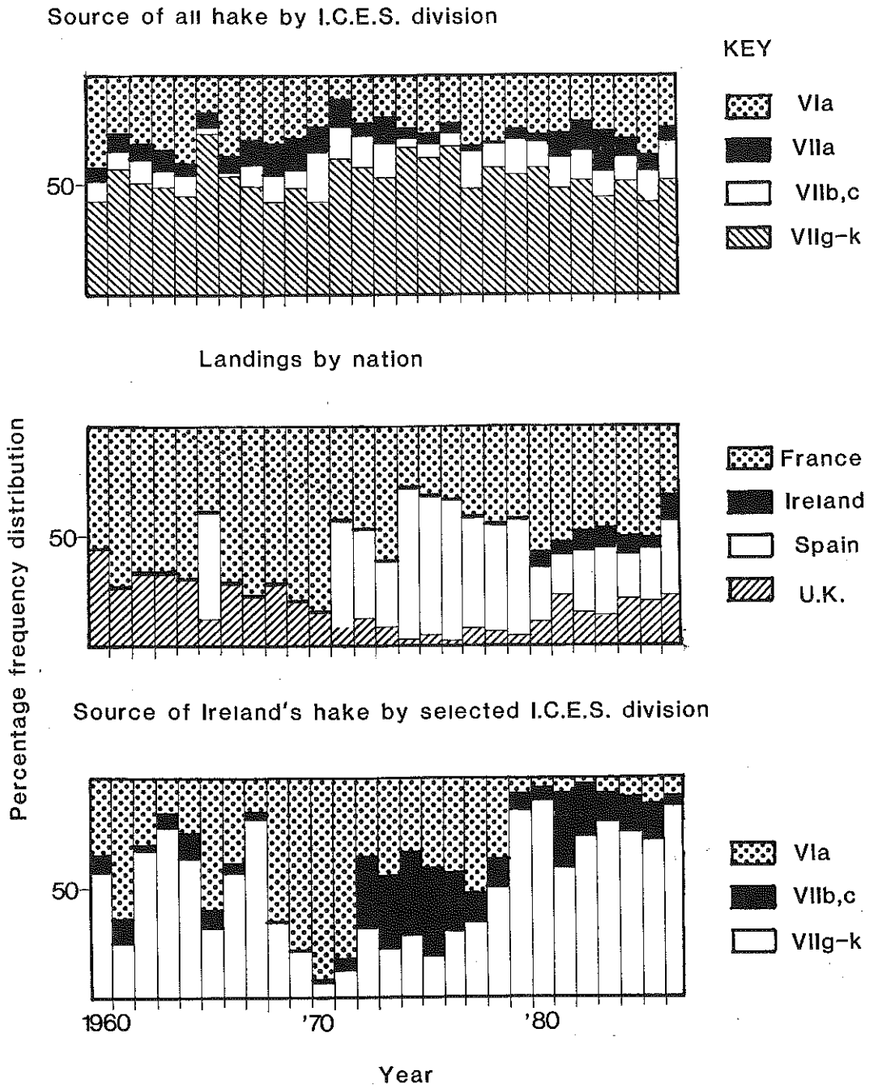

Fig. 1 Hake landings from ICES divisions adjoining Ireland from 1960 to 1986.

grading of landings is into *Merluza,* large hake, and *Pescadilla,* literally, small fish. The dividing weight for these is, roughly 1-1.5kg. A percentage breakdown of landings by the Eiranova joint venture fleet, confirms that longliners take larger fish than trawlers but otherwise there is no clear seasonal pattern in these figures (Table 3).

MATERIALS AND METHODS

Hake landings from ICES divisions other than VIIa have been sampled in varying intensity since 1986. Landings from Irish trawlers and gill-netters were sampled at Rossaveal (VIIb), Castletownbere (VIIj) and Dunmore East (VIIg) throughout the year. These collections were supplemented by samples from Dingle (VIIj) and Burtonport (VIa) in the summer months of some years. The landings of the joint venture (Spanish-Irish) fleet, longliners and demersal trawlers, were sampled at Castletownbere.

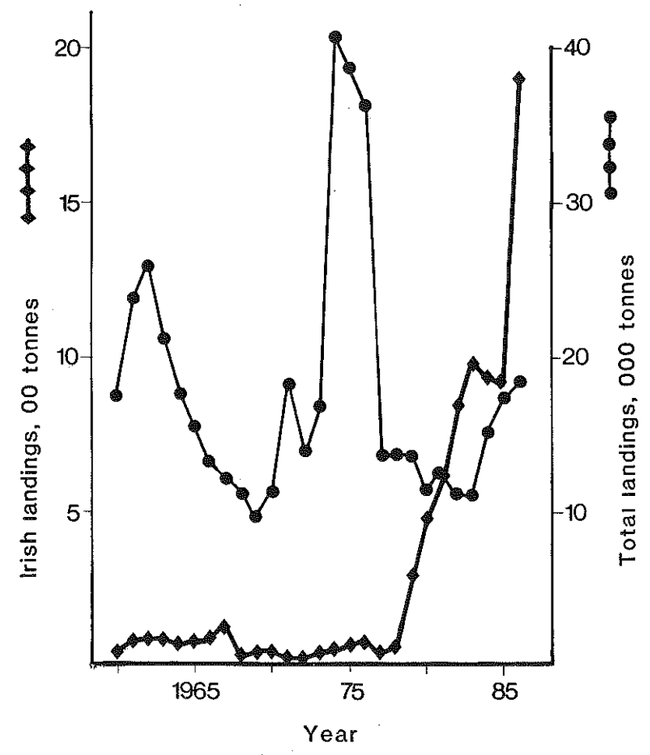

Fig. 2 Landings of hake by Ireland and all nations from 1960 to 1986.

Length frequencies constituted the majority of samples but these were supplemented by aged hake for which weight data were also collected.

Discards were examined from Irish vessels targeting Nephrops and whitefish.

Hake were aged using the otoliths. Trial readings were carried out on sectioned material and on whole otoliths which had been immersed in a mixture of water (60%), glycerine (40%) and thymol (1g per 4 litres) for at least 48 hours prior to interpretation. The latter technique was the one adopted.

There was insufficient material to provide quarterly age length keys but, because annulus formation occurs mid year (Hickling, 1930) it was necessary to treat the samples on a half yearly basis.

RESULTS

Growth

The interpretation of hake otoliths is controversial, there being a wide range of growth patterns, apparently dependent on date of spawning (Pineiro and Hunt, 1989). Ageing is best undertaken using length frequency material and by reference to aged individuals.

Length frequency distributions of discard hake were assembled by quarter (Fig. 4). The distributions are not interpreted as a comprehensive sample of available hake; the smallest individuals were not sufficiently large to be retained by the commercial meshes in use.

The first quarter is dominated by hake in the length groups 9-24cm. Otoliths from this group did not have an annulus and thus they were 0 group fish; however, going by the convention of a birth date of 1 January, they belong to the 1+ group. In the second quarter hake of 5-7cm made their appearance; those that were encountered had been fortuitously trapped among the legs of Nephrops and they were not representatively sampled so their absence from other samples should not be taken to indicate they were not present. This particularly applies to samples taken in the third quarter where the constraints of dealing with commercial material may have distorted the length distributions. Hake in the discards of the fourth quarter consisted of 0+ and 1+ age groups.

Otoliths were removed from 964 hake and 674 of these were confidently interpreted, a success rate of

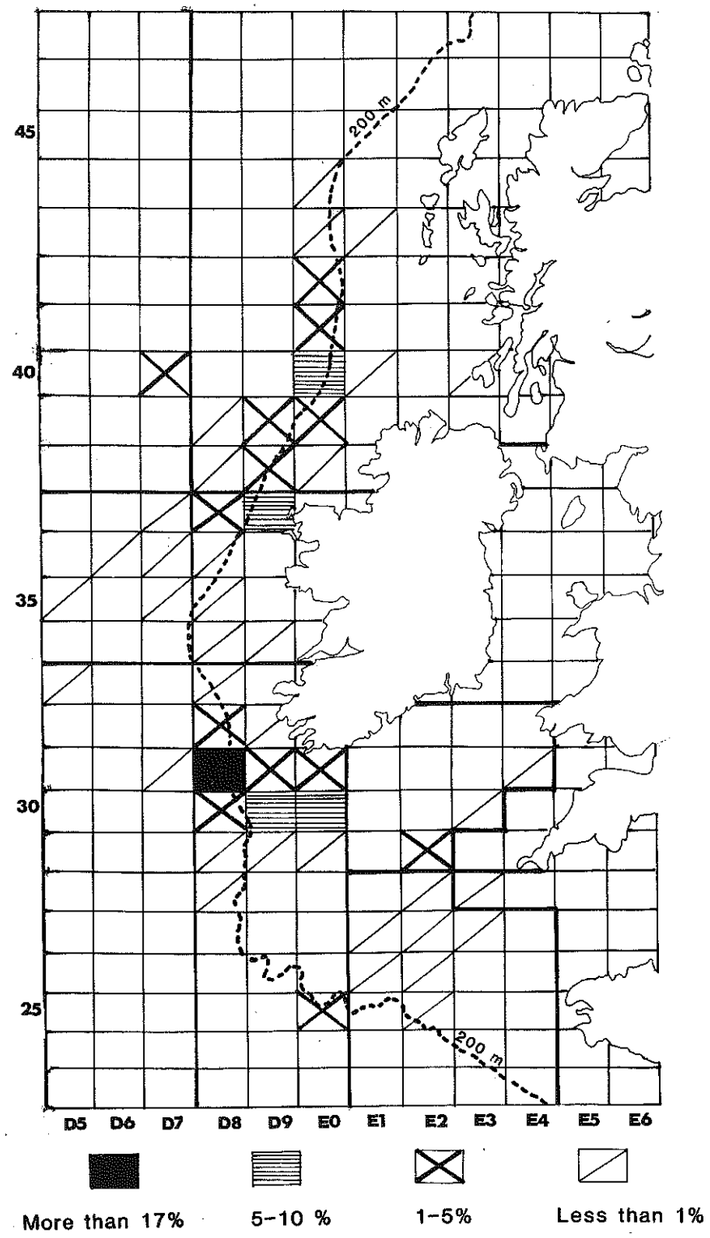

Fig. 3 Distribution of effort by longliners of the joint venture fleet targeting hake between 1985 and 1991. The percentages are based on an analysis of 24,795 hours.

70%, lower than Hickling's 80% (Hickling, 1930). The attribution of age to these fish (landings and discards) is set out in Table 4. In arranging the data in this table a decision on birthdate was essential. According to Hickling the formation of the translucent hyaline band takes place in August, corresponding with a period of recovery following spawning. This annual cycle is observed by immature fish also. Pineiro and Hunt (1989) maintained that, in the Southern hake stock, annulus formation is complete at the end of April. In the present investigations, the length of hake in a particular age group was lower in the second than in the first

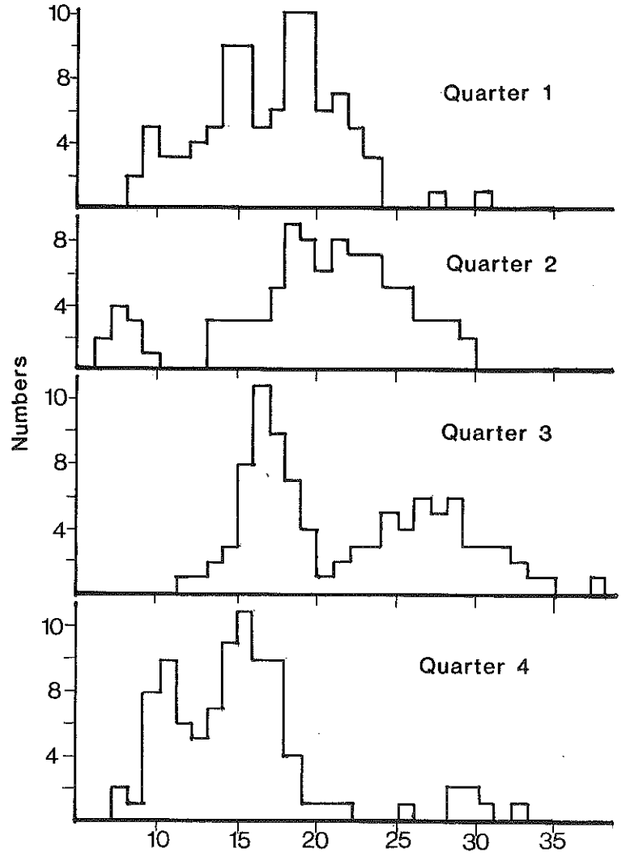

Fig. 4 Length frequencies of juvenile hake from trawls fishing whitefish and *Nephrops* in 1991.

half of the year (Table 5), appearing to confirm Hickling's interpretation. In accordance with this interpretation, an extra year was added to all hake read in the first half of 1991.

The results of otolith interpretation reveal a wide range of length at age. Comparison with Hickling's results is shown (Fig. 5), suggesting that a fairly similar size range ococurs in both investigations. The mean lengths at age are however larger in this investigation than in Hickling's or in the majority of others available to date. This is also true of the lengths at age used by Mesnil and Guichet (1991), the most recent assesment available.

Weight: length relationships

The following weight at length relationships, resulting from investigations in 1991 have been used to convert length frequencies to weights:

Source	Season	Slope	Intercept
Longline/gillnet	First half	2.89	−4.67
Longline/gillnet	Second half	2.87	−4.63
Trawl caught (Ir)	First half	2.88	−4.63
Trawl caught (Ir)	Second half	2.93	−4.79
Trawl caught (Sp)	First half	2.93	−4.63
Trawl caught (Sp)	Second half	2.95	−4.97
All landings	Whole year	2.87	−4.58
Trawl discards	Whole year	3.07	−5.34

All landings were gutted; discards were round.

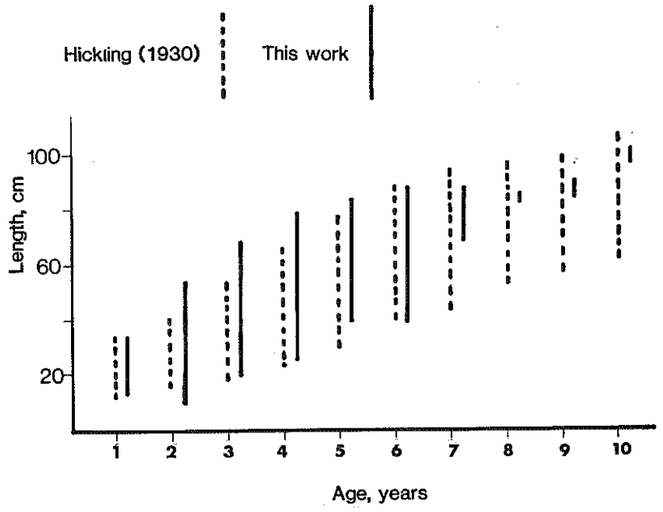

Fig. 5 Range of length at age of hake interpreted in this work and by Hickling (1930).

Landings

Length frequency distributions of hake landings in 1991 are set out in Table 6 where they are arranged by gear, the length frequencies having been standardised to 1,000 tonnes for comparability. Samples were collected randomly, and the apportionment of proportions taken among them, on this basis, in 1991 to landings mainly in VIIj is set out in Table 7. Of the four gear/fleet combinations in this table, Irish trawl takes the greatest share of the landings with gill nets a close second.

The evolution of the hake fishery since 1986 is set out in Table 8. the data contained are based on market intelligence and information obtained during sampling. They are not however absolutely reliable and should be regarded as indicators only.

Irish fleets have taken an increasing share of the landings from Sub-area VII and, since 1989, a growing proportion of this has been captured by gill-net.

Year class strength

Several of the fishing methods used by the Irish and joint venture fleets are selective: notably gill nets and long lines taking larger fish. Insufficient sampling of joint venture trawls had been undertaken but annual length frequency distributions of hake taken by Irish trawl are available since 1986 (Table 9). These data are distributed among age groups using three age at length keys: the one devised in the present investigations, an ALK from the vessel *Cirolana* (Anon 1986) and the 1987 Normsep distribution obtained by Guichet (pers. comm).

The results are set out in Table 10 where the first two keys provide fairly similar age disrtibutions suggesting the age of recruitment is 3+ years. The ALK from Guichet suggests an age of recruitment of 4+.

There are few notable features in the age frequencies apart from a strong 3 year class in 1987 which remains prominent as a 4 year old one the next year.

Discards

In 1991 18 samples of discards were analysed from fleets targeting *Nephrops* and whitefish in Division VIIj. The weight of discarded hake was estimated as a percentage of the total discards associated with each sample. Two co-operatives, one buying-in from a fleet fishing *Nephrops* and whitefish, the other from a whitefish fleet using a larger cod end mesh size, provided details of all purchases in 1991 from which the percentage of hake in the total sales was calculated. The proportion of hake discards to total discards per sample was then expressed as a percentage of the hake fraction in the total landings handled by the Co-operatives. This method of calculating the discard fraction (Table 11) is cumbersome and, because the total purchases to a Co-operative will include an increasing quantity of gill net caught hake which have no discards, it is likely to be an underestimate of the discard fraction. It is notable that the Co-operative which has a prawn-directed fishery has greater discards of juvenile hake than the other whose boats use a larger mesh size.

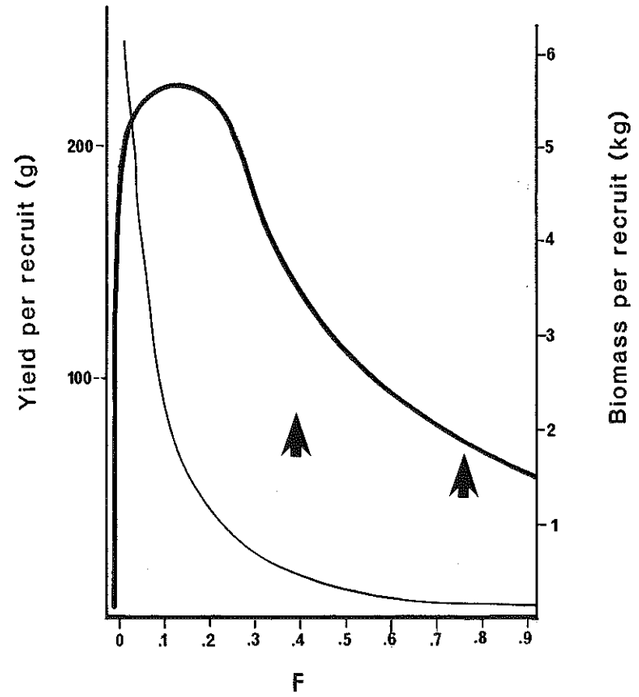

Fig. 6 Yield and biomass per recruit curves for hake based on growth parameters in Anon (1991). Estimates of current fishing mortality (F) are arrowed. (Parameters for these calculations are $W\infty = 8202$; $K = 0.09$; $t_o = -0.07$; $M = 0.2$; $tc = 1$; $tr = 3$).

Survival

In order to compile a survivorship curve, annual length frequency distributions raised to the relevant proportions of estimated catch (Table 12) were assembled with discard data for the trawl fisheries (Irish and joint venture) (Table 11). The discard figure applied to the Irish trawl fishery was averaged from the data in all quarters in Table 11 (*0.85) but, for the joint venture fleet, the average was taken from the data pertaining to the large meshed whitefish fleet (*0.27). Applying the ALK derived from these investigations to the totalled length frequencies, gives the percentage age distributions in Table 13.

The second survivorship table is derived from graded landings to the Co-operative buying from whitefish vessels (Table 14). The numbers per grade were derived from the average weight per grade as observed in 1990. Using the weight:length relationship for Irish trawl caught hake, the numbers of hake per grade were equally distributed among each 5cm length interval in that grade. Finally, the totalled numbers per 5cm interval were disaggregated by the ALK derived from this work.

The total mortality coefficient (Z) was calculated from the slope of the log percentages ages 3-10 of the 1991 landing, most of the discards being in the earlier age groups. In the case of graded hake, ages 3-10 were also used, recruitment being regarded as complete at age 3.

The values of Z arising from these regressions are, in the case of catches in 1991, 0.96 ($r = -0.99$ $P<0.001$) or, taking an M value of 0.2 into account, 0.76, which is very high. Based on the graded landings, the value of Z is 0.60 ($r = -0.98$), or taking an M value of 0.2 into account, 0.40, a value which is also high in relation to F max (Fig. 6).

DISCUSSION

This assessment of the Northern hake stock, mainly in Division VIIj, is heavily dependent on the ALK derived from material collected in the course of the investigations. While this is in agreement with keys for the Northern stock devised by similar means, notably those from the *Cirolana* (Anon 1986) and Hickling (1930), keys devised by statistical methods, particularly Normsep, tend to give lower mean lengths at age. Success at interpreting otoliths was in this case low (compared with Hickling) and it is possible that the more easily

read were those of the faster growing fish whose annuli were more widely spaced and, hence, easier to interpret. Thus, it is accepted that there may have been a bias towards greater lengths at age.

Calculated on this basis, the values of F are very high and would have been reduced had a slower growth rate been used. However, even if they were reduced by half, the F values would still be high compared with those used by Mesnil and Guichet (1991).

That the hake stock exploited by vessels based in Ireland has declined over the past six years there can be little doubt. Its brief history does not permit the nature of this decline, whether it be short or long term, to be identified. Attempts to correlate the CPUE index with others for the same period concluded that, while the fraction of the stock fished by Irish vessels appeared to be reducing, the Southern hake stock was increasing. The identity of the Northern hake as a unit stock is, however, largely a management concept; it may comprise sub-divisions, for example.

Indicators suggest that part of the Northern hake stock fished by Irish based vessels is under some pressure. Interest in it, not least by Irish vessels, has been sharply increasing. Not merely has the share of the landings to Irish vessels increased in the recent past, but the methods by which the Irish catch is taken have continued to diversify, the latest development being a directed gill net fishery. While this improves the exploitation pattern, its significance for the spawning biomass on the Western shelf remains to be evaluated.

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Table 1. Catch per effort of hake by the Spanish joint venture fleet.

Year	Quarter	TRAWL		LONG LINE	
		CPUE quarterly (kg/hr)	CPUE annual (kg/hr)	CPUE quarterly (kg/hr)	CPUE annual (kg/hr)
1985	1				
	2	82.67			
	3	23.57			
	4	16.01	30.05		
1986	1	24.13		36.58	
	2	56.10		84.62	
	3	22.42		60.31	
	4	24.12	35.41	22.92	62.57
1987	1	77.00		46.38	
	2	33.20		96.00	
	3	38.76		37.78	
	4	41.22	47.31	31.37	52.17
1988	1	48.41		62.21	
	2	56.10		84.62	
	3	19.29		70.01	
	4	19.07	42.33	40.20	76.26
1989	1	30.41		25.75	
	2	21.55		113.67	
	3	15.44		29.53	
	4	9.32	16.84	11.05	52.77
1990	1	7.23			
	2	12.77			
	3	12.09		30.39	
	4	5.00	10.69	21.84	26.66
1991	1	7.87		12.34	
	2	12.08		32.71	
	3	12.35		17.26	
	4	10.54	10.86	36.21	23.21

Table 2. Correlation of joint venture trawl indices of CPUE for hake with CPUE indices from other metiers in sub-areas IV, VI, VII and VIII, between 1985 and 1990.

	r	P
Irish joint venture long line	.79	n.s.
Spanish bottom otter trawl, VII	.65	n.s.
Spanish long line, VII	.20	n.s.
French trawl, IV and VI (Lorient)	.27	n.s.
Spanish trawl, VIII	.34	n.s.
French trawl, VIII (Lesconil)	−.83	<0.05

Table 3. Percentage of hake landings by joint venture vessels to consist of large fish (Merluza) in each quarter of three years. The remaining components of the landings are known as Pescadilla, literally "little fish".

	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Captures by long line	1989	76.9	81.5	95.4	73.9
	1988	100.0	61.9	70.7	88.4
	1987	49.2	77.0	52.6	45.2
Captures by demersal trawl	1989	2.8	6.1	n.a.	n.a.
	1988	7.3	7.3	10.0	n.a.
	1987	29.2	22.6	18.3	12.9

n.a. = not available.

Table 4. Length at age data for hake sampled in 1991.

Length interval cm	LENGTH 1	2	3	4	5	6	7	8	9	10+	TOTALS
5											
10		5									5
15	4	24									28
20	27	29	4								60
25	32	37	8	1							78
30	19	53	30	8							110
35	9	29	37	9							84
40		19	30	11	3	1					64
45		6	16	13	6	2					43
50		5	12	15	7	3					42
55		1	16	28	13	1					59
60			9	12	5	2					28
65			4	6	11	4					25
70			3	6	8	5	2				24
75				2	1	3	2				8
80					2	1	1				4
85					1	1		2			4
90						2	1				3
95								1	1		2
100									1	1	2
105										1	1
TOTALS	91	208	169	111	57	25	6	3	2	2	674
Average lengths	24.5	28.5	40.5	50.9	58.8	65.4	76.7	88.3	100.0	105.0	

Table 5. Length (cm) at age of hake sampled in the landings during 1991. Growth in the first half is interpreted as age = annuli +1.

Age	SAMPLES Landings first half	Landings second half
1		32.4
2	38.6	35.9
3	47.1	43.7
4	59.6	47.0
5	68.3	62.4
6	74.4	72.4
7	79.6	78.1
8		88.9
9		102.5
10	102.8	
11	108.6	

Table 6. Length frequency distributions of hake captured by gill net, Irish trawl, longline and Spanish trawl in the first and second halves of 1991.

Length cm	FIRST HALF Gill net	Irish trawl	Long line	Spanish trawl	SECOND HALF Gill net	Irish trawl	Long line	Spanish trawl
20		1		1		1		21
25		16		53		18		456
30		91		343		195		779
35	1	155	8	327		207		420
40	13	130	24	275		145	16	180
45	6	80	24	193	2	83	6	195
50	11	82	73	101	15	90	61	123
55	24	84	73	70	15	92	99	108
60	103	88	81	75	48	84	163	41
65	94	66	89	63	57	76	125	51
70	123	63	89	30	86	33	80	21
75	64	30	65	9	73	18	45	5
80	33	21	16	7	58	20	29	10
85	6	10	8	4	38	11		
90	9	7	8	1	15	2		
95	1	4	0	2	6	2		
100	1	1	8	4	2	2		
105		0		1				
110		1						
TOTAL	490	930	569	1,562	415	1,079	624	2,410
Average Weight (kg)	2.04	1.08	1.77	.64	2.40	.93	1.60	.41

Table 7. Details of hake sampled in 1991.

		Irish trawl	Spanish trawl	Long line	Gill net
Numbers	Half 1	1,661	1,332	70	343
	Half 2	470	1,322	195	576
Weights	Half 1	1.08	.64	1.77	2.04
	Half 2	.93	.41	1.6	2.4
Sampled weights (kg)	Half 1	1,793.88	852.48	123.90	699.72
	Half 2	437.10	542.02	312.00	1,382.40
TOTALS		2,230.98	1,394.50	435.90	2,082.12
Percentage weights		36.31	22.70	7.10	33.89

Table 8. Method/fleet of capture of hake landed to Ireland from sub-area VII, expressed as a percentage, 1986-1991.

Method of capture	1986	1987	1988	1989	1990	1991
Gill net				8	28	34
Long line	22	11	4	4	5	7
Irish trawl	34	31	55	66	48	36
Spanish trawl	44	58	41	13	15	23
Other (Danish seine)				8	4	

Table 9. Length frequency distribution of hake landings from Irish trawl to Ireland, between 1986 and 1991 inclusive. The landings come mainly from Divisions VIIb and VIIj,k and VIIg. The length frequencies are based on landed weights of 100 t.

Length cm	1986	1987	1988	1989	1990	1991
20	.00	.01	.02	.60	.06	.10
25	3.68	1.63	.79	6.75	1.30	1.67
30	17.00	21.20	3.50	21.80	7.68	13.47
35	11.97	25.28	6.13	12.53	14.96	17.80
40	6.85	14.63	10.02	10.48	20.08	13.78
45	6.05	8.96	16.66	6.62	16.04	8.18
50	6.37	5.74	17.47	6.03	11.06	8.62
55	9.20	3.53	14.98	5.77	7.75	8.82
60	8.66	4.84	10.87	7.63	7.45	8.75
65	10.45	4.09	6.65	7.67	6.01	7.07
70	9.90	3.88	5.04	6.13	3.42	5.13
75	6.17	2.36	2.55	2.85	1.84	2.55
80	2.45	2.26	2.14	1.09	1.12	2.04
85	.78	1.14	1.37	1.31	.62	1.04
90	.26	.24	.88	1.35	.33	.51
95	.20	.21	.47	.90	.15	.34
100	.02	.00	.11	.27	.07	.10
105	.00	.00	.18	.21	.01	.00
110	.00	.00	.10	.00	.04	.03
115	.00	.00	.05	.00	.01	.00
120	.00	.00	.03	.00	.00	.00
Average	53.02	46.05	55.26	49.14	49.57	47.84
Totals	77,240	112,001	81,370	96,840	116,676	100,940

Table 10. Age frequency distributions of hake in the Irish trawl landings 1986-1991, interpreted using three ALKs.

The ALK arising from the present investigations

Age groups	1986	1987	1988	1989	1990	1991	Averages
1	5.66	6.97	1.58	8.05	3.46	4.92	5.11
2	17.60	25.67	11.66	22.81	18.82	19.58	19.36
3	25.85	32.92	28.94	27.55	33.62	30.86	29.96
4	23.14	18.23	29.79	19.62	24.41	22.85	23.01
5	15.61	9.03	17.29	11.44	12.52	12.95	13.14
6	8.46	4.84	7.24	6.55	5.44	6.11	6.44
7	3.07	1.56	1.89	1.95	1.14	1.74	1.89
8	.49	.68	.92	1.10	.38	.69	.71
9	.11	.11	.29	.58	.11	.22	.24
10	.01	9.00	.41	.34	.10	.08	.16

The ALK from Cirolana investigations

Age groups	1986	1987	1988	1989	1990	1991	Averages
1	.00	.00	.00	.00	.00	.00	.00
2	11.57	15.75	3.63	15.64	10.92	8.00	10.92
3	30.21	46.33	29.85	36.96	38.97	42.77	37.52
4	22.10	18.57	31.76	20.00	23.03	25.96	23.57
5	27.98	14.12	26.27	19.35	20.06	18.11	20.98
6	4.64	2.37	3.65	3.03	3.31	2.58	3.26
7	2.67	2.07	3.38	3.39	2.73	2.00	2.71
8	.61	.67	.77	.72	.68	.36	.64
9	.10	.11	.23	.45	.17	.08	.19
10	.02	.00	.46	.48	.13	.14	.21

ALK from Guichet for the year 1987

Age groups	1986	1987	1988	1989	1990	1991	Averages
1	1.29	.68	.29	2.76	.51	.71	1.04
2	13.33	15.70	3.13	18.27	6.73	10.59	11.29
3	19.61	35.13	9.84	23.32	22.28	25.22	22.57
4	23.67	28.96	44.76	23.82	43.76	30.31	32.55
plus group	42.10	19.53	41.98	31.83	26.72	33.17	32.56

Table 11. Estimation of hake discards at two Co-operatives in 1991. Co-op A vessels target *Nephrops* and whitefish; Co-op B vessels target whitefish.

Hake as a percentage of total landings (from Co-op statistics)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Co-op A	3	10	7	4
Co-op B	5	16	9	5

Hake discards as a percentage of total discards (from samples)

		Quarter 1	Quarter 2	Quarter 3	Quarter 4
Co-op A	Mean	4.44	6.43	5.72	6.52
	Range	1.82-7.46		3.04-8.87	1.08-17.07
	No. samples	3	1	5	3
Co-op B	Mean		4.02	2.74	
	Range		0.78-9.36		
	No. samples		5	1	

Ratio of hake discarded to hake landed

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Unionhall	1.48	0.64	0.82	1.63
Castletownbere		0.25	0.30	

Table 12. Length frequencies of hake landings and discards in 1991, based on materials collected in Division Viij.

Minimum length cm	Irish trawl	Spanish trawl	Trawl discards	Long line	Gillnet	Totals
15			1,779.40			1,779.40
20	.72	1.18	1,657.53			1,659.43
25	11.09	31.76	987.21			1,030.06
30	87.54	103.09	219.38		.34	410.35
35	98.87	80.58	36.56	.21		216.22
40	68.25	61.38		1.72		131.35
45	41.00	45.26		1.07	1.36	88.69
50	30.63	24.88		5.37	1.70	62.58
55	28.21	16.83		3.87	3.40	52.31
60	23.88	14.93		5.16	11.91	55.88
65	20.74	13.96		6.45	23.48	64.65
70	17.85	6.64		7.31	24.84	56.64
75	10.13	2.13		4.73	22.11	39.10
80	5.79	1.66		2.36	21.77	31.58
85	2.41	.71		.21	12.59	15.92
90	1.21	.24		.21	5.44	7.10
95	1.45	.47			2.38	4.30
100	.48	.71		.21	.34	1.74
105		.24				.24
110	.24					.24

Table 13. Percentage age frequencies of hake based on landings and discard data in 1991 and on occasionally graded landings in a Co-operative landing whitefish between Quarter 1 1988 and Quarter 4 1991.

Age group	1991 Landings and discards	Graded landings 1988-1991
1	26.69	6.86
2	55.19	16.55
3	10.07	24.65
4	4.07	24.08
5	2.09	14.61
6	1.2	7.83
7	.43	2.39
8	.18	1.47
9	.05	.93
10	.02	.63
Totals	99.99	100

Table 14. Graded hake landings, mainly from division VIIj.

Grades	Limits	Average weight (kg)
1	<0.5	.4
2	>0.5	.6
3	1-2	1.5
4	2-3	2.5
6	4-6	5.0
7	>6	6.5

Weights, kg, per grade

Grade	Q1 '88	Q2 '88	Q3 '88	Q4 '88	Q2 '89	Q3 '89	Q4 '89	Q1 '91	Q2 '91	Q3 '91	Q4 '91	Totals
1	888	12,034	3,316	747	7,027	4,142	808	675	1,260	1,620	2,250	34,767
2	3,227	15,376	4,173	990	17,255	4,107	1,320	2,250	2,115	1,800	1,170	53,783
3	1,630	32,083	8,159	663	31,706	18,809	3,449	855	765	810	495	99,424
4	907	28,306	5,276	742	15,426	9,426	5,282	450	225	225	360	66,625
5	534	10,102	1,822	877	11,090	3,669	1,753	225	90	90	135	30,387
6	453	10,398	1,791	3,288	10,738	5,025	9,368	0	0	0	540	41,601
7					1,154	5,656	8,577	0	0	0	315	15,702
Totals	7,639	108,299	24,537	7,307	94,396	50,834	30,557	4,455	4,456	4,545	5,265	342,289

Number per grade

Grade	Q1 '88	Q2 '88	Q3 '88	Q4 '88	Q2 '89	Q3 '89	Q4 '89	Q1 '91	Q2 '91	Q3 '91	Q4 '91	Totals
1	2,220	30,085	8,290	1,868	17,568	10,355	2,020	1,688	3,150	4,050	5,625	86,918
2	5,378	25,627	6,955	1,650	28,758	6,845	2,200	3,750	3,525	3,000	1,950	89,638
3	1,087	21,389	5,439	442	21,137	12,539	2,299	570	510	540	330	66,283
4	363	11,322	2,110	297	6,170	3,770	2,113	180	90	90	144	26,650
5	153	2,886	521	251	3,169	1,048	501	64	26	26	39	8,682
6	91	2,080	358	658	2,148	1,005	1,874	0	0	0	108	8,320
7	0	0	0	0	178	870	1,320	0	0	0	48	2,416
Totals	9,291	93,389	23,674	5,164	79,127	36,433	12,326	6,252	7,301	7,706	8,244	288,906
Ave. Weight (kg)	.82	1.16	1.04	1.41	1.19	1.40	2.48	.71	.61	.59	.64	1.18

Numbers per 5cm length interval

cm	Q1 '88	Q2 '88	Q3 '88	Q4 '88	Q2 '89	Q3 '89	Q4 '89	Q1 '91	Q2 '91	Q3 '91	Q4 '91	Totals
20	444	6,017	1,658	374	3,514	2,071	404	338	630	810	1,125	17,384
25	444	6,017	1,658	374	3,514	2,071	404	338	630	810	1,125	17,384
30	444	6,017	1,658	374	3,514	2,071	404	338	630	810	1,125	17,384
35	444	6,017	1,658	374	3,514	2,071	404	338	630	810	1,125	17,384
40	444	6,017	1,658	374	3,514	2,071	404	338	630	810	1,125	17,384
45	2,689	12,813	3,478	825	14,379	3,423	1,100	1,875	1,763	1,500	975	44,819
50	2,689	12,813	3,478	825	14,379	3,423	1,100	1,875	1,763	1,500	975	44,819
55	362	7,130	1,813	147	7,046	4,180	766	190	170	180	110	22,094
60	362	7,130	1,813	147	7,046	4,180	766	190	170	180	110	22,094
65	362	7,130	1,813	147	7,046	4,180	766	190	170	180	110	22,094
70	181	5,661	1,055	148	3,085	1,885	1,056	90	45	45	72	13,325
75	181	5,661	1,055	148	3,085	1,885	1,056	90	45	45	72	13,325
80	76	1,443	260	125	1,584	524	250	32	13	13	19	4,341
85	76	1,443	260	125	1,584	524	250	32	13	13	19	4,341
90	45	1,040	179	329	1,074	503	937	0	0	0	54	4,160
95	45	1,040	179	329	1,074	503	937	0	0	0	54	4,160
100	0	0	0	0	89	435	660	0	0	0	24	1,208
105	0	0	0	0	89	435	660	0	0	0	24	1,208

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